4. EAST OF BEN LOMOND – COKERS RIDGE

The Mathinna Beds between Ben Lomond Plateau and Tower Hill, and south of the South Esk River present strong magnetic character. The nature of the field is both abnormal in amplitude and particularly definite in orientation – and is clearly anomalous for these rocks.

The abnormal character of the region is well displayed in the image (Figure 22). The relatively subdued magnetic field in the north west corner of the image is associated with exposed granodiorite of the Scottsdale Batholith and the first high amplitude effects south east of this are related to the limit of mapped thermal alteration (see Figure 25). With the exception of the response due to Jurassic dolerite on West Tower (far SE corner of maps) all other character is derived, apparently, from "normal" Mathinna Beds. Although trends are maintained there is a marked change in amplitude near the axis of the South Esk River west of Brooks Creek.
The available geological mapping of the region (Calver *et al*, 1988; McClenaghan *et al*, 1993) does indicate that the magnetic trends do represent real lithological or structural changes within the Mathinna Beds suite. Mapping records some differences in terms of pelitic composition or shearing. Most of this information is restricted to the Alberton map sheet (north of 5406 000 mN). Contour presentations present proper scaling of the anomalies (Figure 23) and their correlation with geological features as mapped (Figures 24 and 25).

Although gravity data are very limited there is no indication, in keeping with absence of mapped indications of shallow halo effects, of any relatively shallow granitoid beneath the anomalous region. Granodiorites might not be recognised with existing data or coverage.

The combination of extant surface mapping and gravity data implies, however, when coupled with the new magnetic data, that the 'anomalous' effect is quite local and structurally constained, and not an immediate or obvious artefact of thermal alteration. There are several grounds for this conclusion.
Review of the metamorphic halo responses elsewhere in northeast Tasmania does not indicate any consistent pattern of magnetic response for either the Mathinna Beds or its alteration zones. Indeed, there is often (usually) a loss of character rather than a gain where altered. See Scamander region, and the discussion for both Skyline intrusions and Catos Creek, this report.
There is thus little case to suggest that the strong responses seen near Cokers Ridge are due to thermal alteration, and certainly not in isolation from other factors or processes. The signature may require the presence of specific pelitic units in a particular part of an aureole, for example, although this approaches special pleading and patches of the signature do occur elsewhere (e.g., east Gladstone, section 2, this report).
Further, stratigraphic unit effects in the present situation cannot be traced in any form, even with reduced amplitude, consistently from those trends in the core anomalous zone. The image and contour presentations suggest sharp terminations of source and magnetic character, especially on the northwest and southeast faces of the anomalous block – and some structural controls are implicated.
Mapping, where lithological variations are recorded, suggests local variations in composition of the rock suite which would accord with such views.

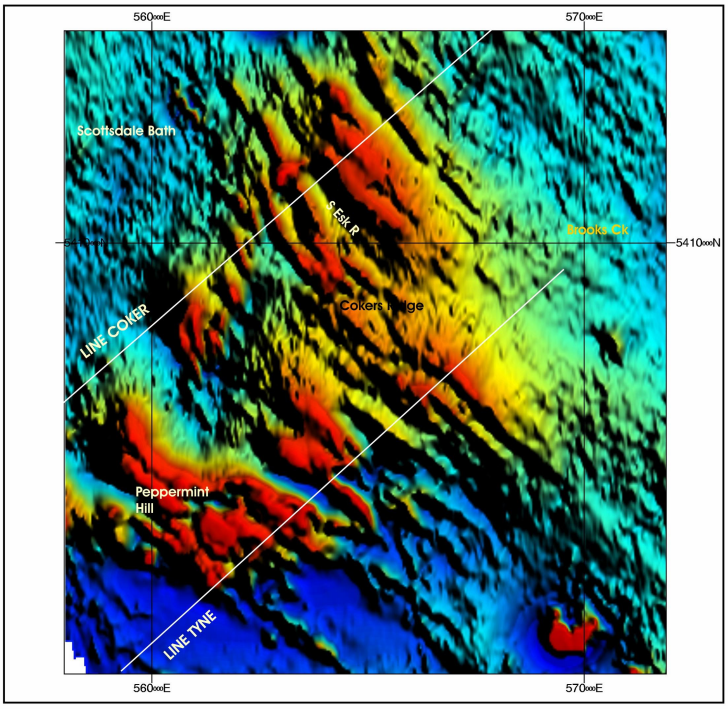

Figure 22: Image of Total Magnetic Field Intensity in region east of Ben Lomond.

Two sections were tested in order to examine the possible implications if Mathinna Beds sources are required to account for the magnetic field. Both sections are oriented approximately NE-SW so as to sample the anomaly trends reliably. The southern section, named Tyne, ends at Brooks Creek while the northern section, named Coker, samples the grain just beyond the batholith halo and examines the structure north of the South Esk River.

The modelled sections are shown in Figure 26. The location of sections is shown in Figures 22, 23, 24 and 25.

Section TYNE: Peppermint Hill to Brooks Creek.

TYNE shows that all features exemplified by character near Peppermint Hill can be directly explained by variations within the Mathinna Beds sequence. Four of the unit variations inferred possess properties considered normal for the sequence (and observed near Gladstone) and only three have raised contrasts. Two of these are not significantly higher than observed values. Two of the more anomalous units can be directly correlated with mapped pelites or extrapolations of their exposure (see Figure 25). The unusual element, therefore, is their accumulation in a restricted zone as a package – as at Gladstone – and it may well be that a particular part of the Mathinna Beds is magnetically anomalous, and that this is a primary property. It may well be age constrained. In this southern zone it is not structurally constrained within the terms of the model.
The inferred contrasts for units in the model are, from west to east, 0.0078, 0.0039, 0.004, 0.0026, 0.0013, 0.0013, 0.0013 SI respectively.

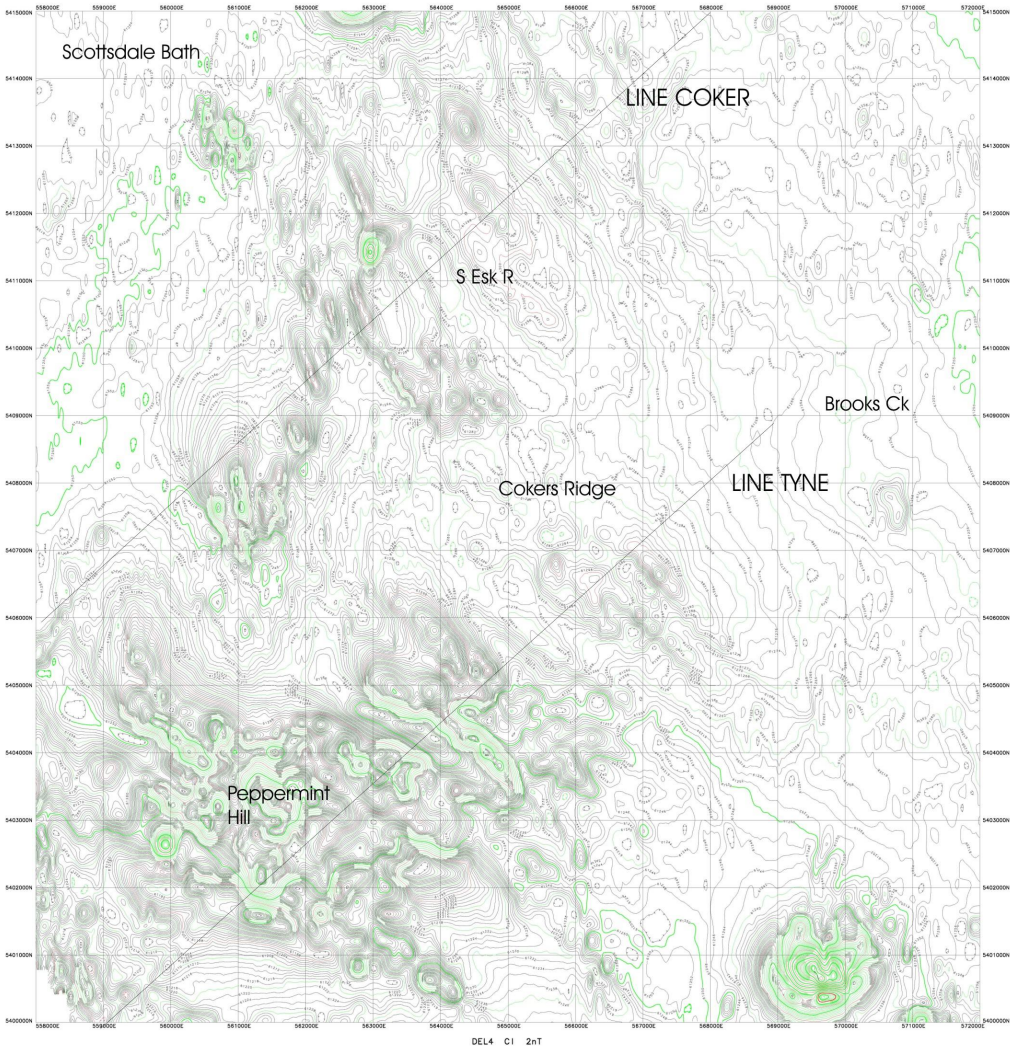

Figure 23: Contour presentation of Total Magnetic Field Intensity in region east of Ben Lomond.

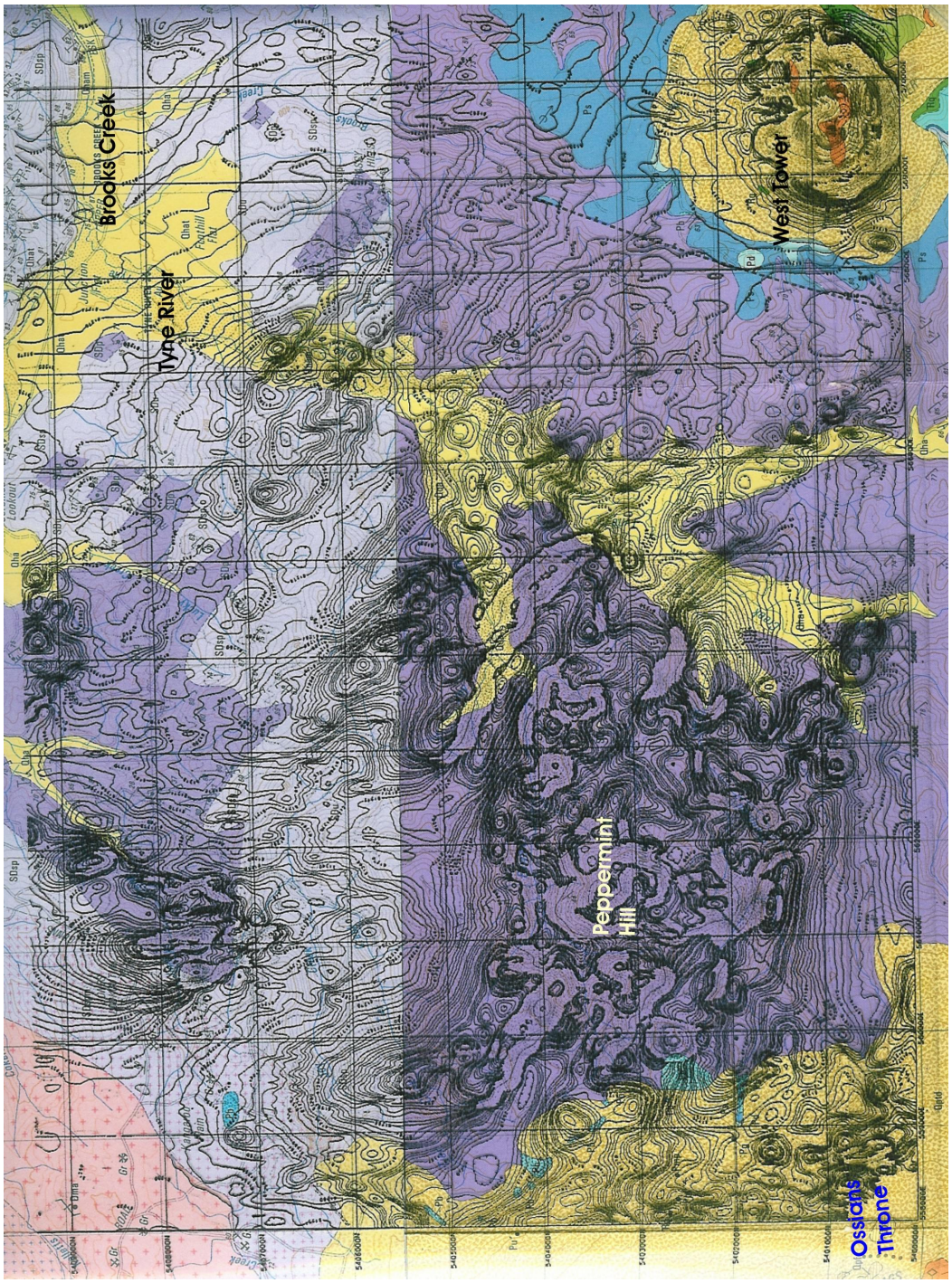

Figure 24. Mapped geology and magnetic field intensity, southern zone (Tyne).

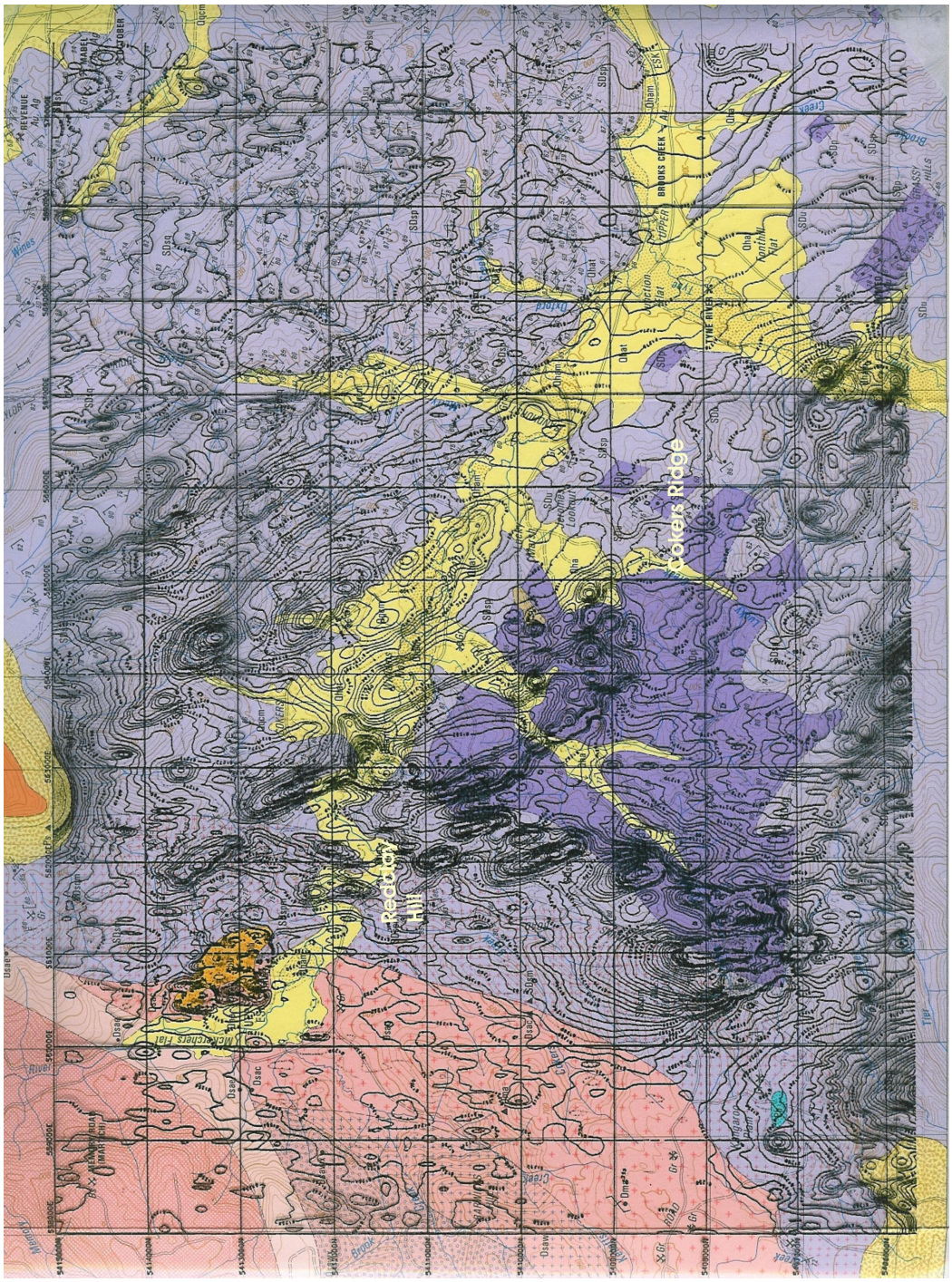

Figure 25. Mapped geology and magnetic field intensity, northern zone (Coker).

Section COKER: near batholith margin and Redclay Hill.

The section COKER, which extends across the metamorphic halo near Redclay Hill, the northern limit of mapped pelites, the valley of the South Esk River, and the hills between the South Esk River and Dans Rivulet, shows that structural limitations are involved.
The magnetic Mathinna Beds rock package is constrained southwest of the South Esk River.

The model indicates that a large block of section is pelitic with the normal magnetic properties for such material (approximately 0.0026 SI, colour yellow). Superimposed on this, as units within the basic suite, are several other variants with properties consistent with those noted further south in section TYNE.
The inferred magnetic properties for each unit, from west to east, within the pelitic package are 0.0036, 0.0049, 0.0039, 0.0065, 0.0065, 0.0065, 0.0039, 0.0058, 0.0039 SI. There is nothing in either profile to indicate any more complex constitution, such as hidden plutons or halo alteration zones.

Model COKER does, however, show that the units north of the North Esk River do not possess the same depth range and are less magnetised. Depth range is not well constrained in any modelling since much depends on realistic property assumptions and the limits gradients impose on depth to top, and width, of source. In most cases the magnetic properties are fully realised within 50 to 100 metres of the land surface.

The basic form of the magnetic field is asymmetric with a distinct reduction north of the river and this is best explained by a north dipping truncation of the main pelitic block. Units above this surface are different and cannot be projected below it within the resolution of the present modelling. The implied arrangement of units is highly suggestive of east-facing thrusting which buries the pelitic package and introduces a different suite.
Gold mineralisation at Mathinna (just east of the section TYNE but which extrapolation would suggest is north of the implied thrust) and at Tyne River and Brooks Creek (both alluvials) appears to be contained in the rock suite directly above the thrust, or have been introduced along it.

These models (like those at Gladstone – Blue Tier, above) show that useful information about the Mathinna Beds might be gleaned by close analysis of the magnetic data and that, wherever distinctive character is present, important structures might be defined.

Note that both COKER and TYNE models achieve the anomaly distribution with credible susceptibilities, but a modest total depth range – in this case 4000 metres. The 4000 m figure is not especially critical or sensitive but at least 2000 to 3000 m of vertical extent is involved. All dips have been indicated as near vertical but there are suggestions that some members dip steeply west, others steeply east. Magnetic zones of this type within the Mathinna Beds will probably repay more detailed evaluation and interpretation as comments for Section 3 of this report also note.

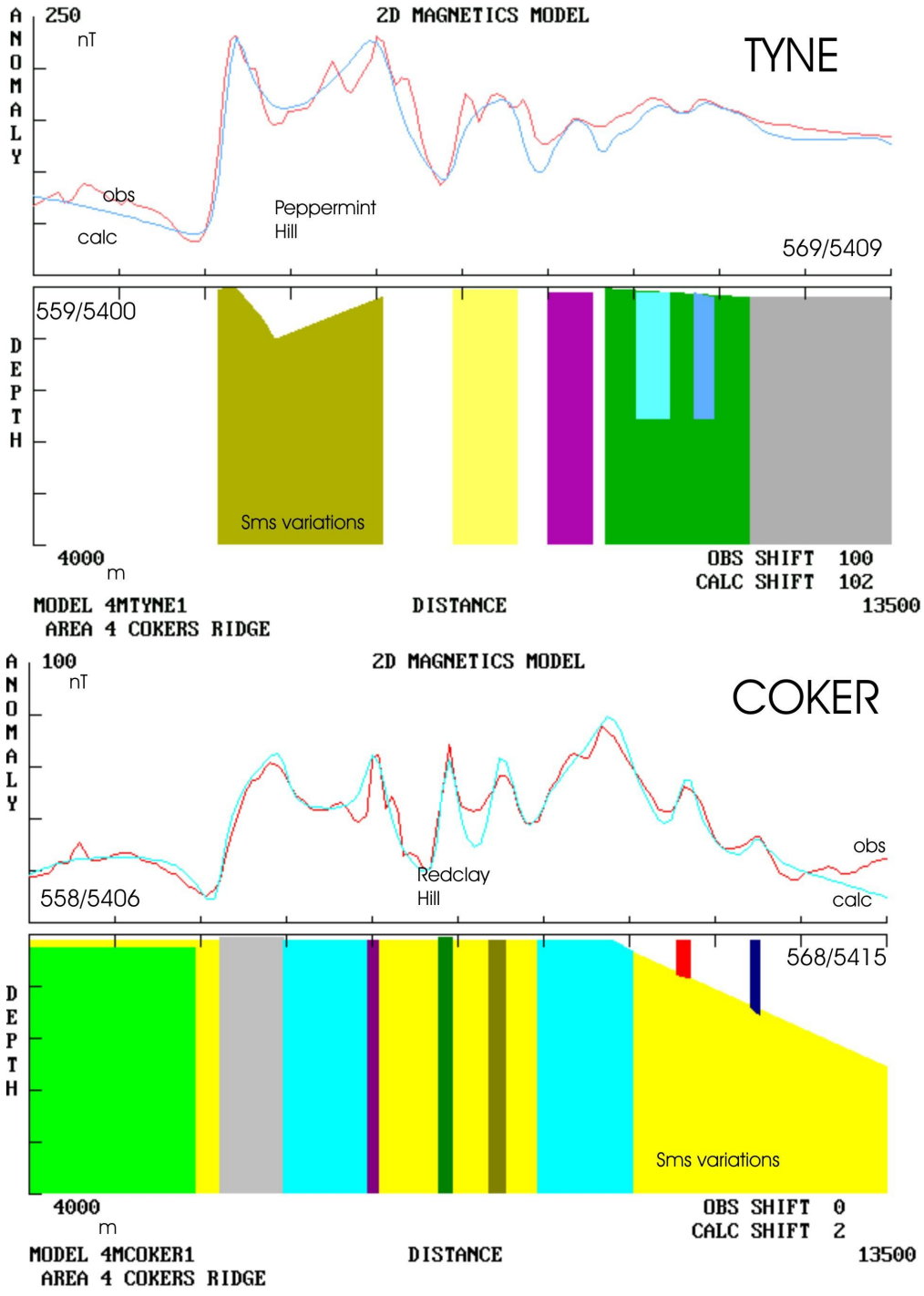

Figure 26. Modelled sections across Mathinna Beds west of Ben Lomond.